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In This Issue

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The use of lasers in dermatology and plastic surgery has increased by orders of magnitude with the exploitation of the theory of selective photothermolysis leading to the development of new lasers with wavelengths throughout the visible and infrared region and pulse durations from milliseconds to nanoseconds. This special issue focuses on the two areas with the greatest current concentration of research effort and clinical application development in laser skin surgery, namely laser skin resurfacing and laser hair removal.

Since its introduction five years ago, CO_2 laser skin resurfacing has revolutionized the treatment of mild to moderate actinic damage and its associated rhytides. However, along with its demonstrated efficacy, a number of disadvantages and complications have been reported.

One limitation has been the prolonged erythema experienced by many patients after CO_2 laser resurfacing. The erythema is thought to be related to the thickness of residual thermal damage as well as depth of ablation. The Er:YAG laser has been found to leave behind far less thermal damage than the CO_2 laser. The articles by R.A. Weiss et al. and by T.S. Alster describe their experience with Er:YAG laser resurfacing. Another option for reducing CO_2 laser residual thermal damage is to ablate the thermally coagulated tissue with an Er:YAG laser. The study by D.S. Utley et al. compares the effects of CO_2 resurfacing alone with CO_2 resurfacing followed by Er:YAG laser ablation of some of the CO_2 induced thermal damage leading to reduced erythema.

Scarring after CO_2 laser resurfacing has been an infrequent, but potentially devastating complication which may be related to factors intrinsic to the patient and extrinsic related to the procedure. Depth of ablation and thermal coagulation are the factors most intimately related to the device used and the technique employed by the laser operator. The study by E.V. Ross et al. examines the effect of resurfacing CO_2 laser "pulse stacking" on the depth of thermal injury while J.E. Fulton et al. look at the pattern of residual thermal injury after CO_2 laser resurfacing. Fulton's results may help to explain some of the variability seen when treating different patients with the same laser parameters.

In addition to the treatment of rhytides and acne scars, numerous other indications for the resurfacing lasers have been reported. C. Raulin et al. report on their experience with a CO_2 resurfacing laser for the treatment of xanthelasma palpebrum.

Development and use of lasers for hair removal has been increasing at an exponential rate. Early studies most frequently used shorter wavelengths in the 694 and 755 nm range where melanin absorption was quite strong and yet still provided a reasonable depth of penetration. More recently a diode laser with a wavelength of 800 nm has been proven efficacious and even longer wavelengths such as 1064 nm are being considered. Pulse durations were also originally in the shorter range including Q-switched (nanosecond) pulses with the Thermolase system (that also utilized a topically applied carbon based solution) and with 0.3 ms pulses with the first ruby lasers later increased to 3.0 ms in the newer models. Many of the more recently introduced lasers are coming out with longer pulse widths. The Cynosure alexandrite (755 nm) has up to a 40 ms pulse width which may help to spare the epidermis, increasing the safety of this laser for darker skin types. The new 800 nm diode laser (Coherent/Star Medical Technologies, Pleasanton, CA) with a variable pulse width up to 30 ms also spares the epidermis with its longer pulse width as well as longer wavelength and by the cooling device attached. R.A. Weiss et al. report on their experi-

ence with a broadband non-coherent filtered flashlamp intense pulsed light source (EpiLight) for hair removal with 6 months follow-up.

All of the laser hair removal systems can achieve temporary hair reduction. There is still controversy as to which system(s) can achieve permanent hair reduction. The key seems to be multiple treatments, longer wavelength, long pulse duration (>10+ msec), large spot size (>10 mm) and epidermal cooling combined with high energy fluence of 30 or more J/cm^2. The idea is to maximize the amount of energy delivered to the hair follicles in the deep dermis while preserving the overlying epidermis. G. Vargas et al. take a different approach to improve laser light depth of penetration by the use of an agent to reduce skin turbidity partly through index matching.

As we become more comfortable with the idea of permanent hair removal, the definition of permanence needs to be made clear. Permanence should not be interpreted as no hair at all, but as the ability of hair responding to laser treatment to not regrow. We know that hair follicles in the anagen stage are more susceptible to permanent laser injury than those in telogen, but what exactly is the susceptible portion of the follicular apparatus? In the paper by S. McCoy et al., their short-term histologic findings after ruby laser hair removal are presented. Many other variables remain to be explored and ways to optimize treatment and equipment parameters elucidated.

Port wine stains are now routinely, safely and effectively treated with the pulsed dye laser. Recent technological advances have expanded the wavelength range (585–600 nm) and pulse duration (0.45–1.5 msec) of the pulsed dye laser. In spite of these expanded treatment parameters, some port wine stains are resistant to laser treatment. T.J. Pfefer et al. present a sophisticated computer model of expected laser treatment response based on a port wine stain biopsy. An increased understanding of port wine stain laser tissue interaction may lead to the selection of more optimal laser treatment parameters.